



Towards more effective landscape governance for sustainability: the case of RIMBA corridor, Central Sumatra, Indonesia

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Abstract

Over the last two decades, sustainable landscape approaches are increasingly being adopted worldwide. An important challenge for these approaches is to analyse and improve governance systems that promote non-conflicting land uses to provide multiple ecosystem services and safeguard biodiversity for diverse social groups over the long term. Our study provides a diagnostic of the gaps and limitations of the current institutional arrangements of an ecosystem corridor in Central Sumatra covering Riau, Jambi and West Sumatera, known as the RIMBA corridor landscape. We identify actions that stakeholders think should be taken to improve the governance of the RIMBA corridor to achieve sustainable landscape goals. We used a combination of methods, including (1) Focus Group Discussions with key stakeholders of the RIMBA programme; (2) the use of a “context diagnostic approach for conservation” to analyse the results of the Focus Group Discussions; (3) a survey on formal institution design for coordination and management of the RIMBA corridor. We found that although transformational dynamics have already been initiated at the local, provincial and national levels through a pilot project, new regulations and institutional changes, many obstacles to effective governance of the RIMBA landscape still remain. Our study points at the need for a new institution to enable cooperation for green economy policy objectives established through a Presidential Decree to achieve the required institutional innovations at the scales required. Our experimental diagnostic approach can be applied in other settings in Indonesia and elsewhere to analyse and improve the effectiveness of governance for the management of biodiversity and ecosystem services at landscape scales.

Keywords Landscape · Governance · Biodiversity · Ecosystem services · Sustainability · Institutions

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Introduction

Over the last two decades, actors involved in nature conservation have made increasing efforts to improve land-use planning and management at landscape scales to balance economic, social and environmental trade-offs in places where productive land uses compete with biodiversity goals (Bennett and Mulongoy 2006; Sayer et al. 2013; CBD

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2015; Correa Ayram et al. 2016). Sustainable landscape approaches are one way to bring different sectors such as agriculture, forestry, mining and infrastructure together to share a vision and develop consensus for maintaining agreed productivity and environmental values (Sayer et al. 2013). As part of sustainable landscape approaches, wildlife and ecosystem corridors are widely being promoted to enhance, restore and stabilise important ecosystems within a matrix of other land uses, which are also relevant in the context of global environmental change (Reid et al. 2005; Beier et al. 2006; Bennett and Mulongoy 2006; Chazdon 2013). However, governance issues have also been highlighted by conservation practitioners as being a “pervasive challenge” for landscape approaches. Indeed, enhancing connectivity in landscapes requires coordination between multiple stakeholders across scale levels, and therefore requires innovative modes of governance, specifically tailored to address sustainable landscape management challenges (Sayer et al. 2013).

In this paper, we explore the governance challenges of the RIMBA corridor landscape on Sumatra Island in Indonesia. We also discuss ways to improve the design and effectiveness of the corridor’s governance (both formal and informal) in terms of its ability to deliver both ecological and livelihoods outcomes on the long term. The paper builds on the lessons drawn from a previous study (Kelman 2013) that examined an integrated conservation and development project (ICDP) in Kerinci Seblat National Park, one of the core protected areas encompassed by RIMBA corridor. The study shows that the Kerinci Seblat National Park has essentially failed so far to deliver significant conservation and development outcomes, despite heavy investments in terms of financial, institutional and human resources. By comparing this case to a more successful and effective ICDP in Indonesia, the study underlines the importance of: adopting a multi-layered, adaptive and cross-sectoral governance approach; law enforcement and effective action against illegal activities; strengthening institutions at local, provincial and national levels; increasing stakeholders’ coordination and capacity notably through spatial planning activities; and establishing long-term stakeholders’ commitments and partnerships (Kelman 2013). We conducted a participatory process and used an analytical approach rooted in social science theory. This rich empirical case of governance in sustainable landscapes in a tropical context contributes to the current progress in understanding and enhancing the role of social sciences in conservation science (Bennett et al. 2016; Bennett et al. 2017). Our study also adds to the conservation connectivity literature which has been largely focussed on US and European contexts. In terms of a pragmatic contribution to conservation, our results are supporting the implementation of the Sumatra Island Spatial Plan 2012–2032 for the RIMBA corridor.

Addressing governance challenges in landscape approaches

The ability of ecosystem corridors to deliver social and ecological outcomes depends on governance systems shaping the formal and informal norms, rules, incentives and decision-making in individual and collective actions in those contexts (Lebel et al. 2006; Primdahl et al. 2013). Conservation takes place in socio-ecological systems, where it is not just the biophysical dimension of biodiversity-rich places that matters, but also the way humans choose to organise the actions and the decision-making processes that impact these places (Folke et al. 2005; Kareiva and Marvier 2012). The governance dimension of sustainable landscapes concerns the critical interrelations between ecological systems and the social institutions influencing the planning, management and monitoring of natural capital (Selman 2008). The concept of connectivity conservation has evolved to reduce ecological and institutional fragmentation through improving the ability of governance regimes to take into account the intrinsic and instrumental value of sustainable landscapes (Crooks and Sanjayan 2006; Wyborn 2011). While Ostrom (2009) showed the importance of diagnosing governance of socio-ecological systems at multiple spatial and temporal scales, to date expert-led quantitative modelling of land cover and land use change has dominated the quest to establish functional landscape connectivity in conservation practice (Cushman et al. 2013; Sayer et al. 2013; Correa Ayram et al. 2016). To us, the frontier for sustainable landscape approaches seems to lie in achieving meaningful participation and collaboration by different players in conservation practice, science and policy (Brooks et al. 2006; Ostrom 2009; Angelstam et al. 2013; Wyborn 2015), developing workable options for accountability and enforcement (Lebel et al. 2006), finding effective approaches for adaptive conservation decision-making and management with multi-level perspectives (Kenward et al. 2011; Sayer et al. 2013) and understanding in situ resource ownership and use (Wegenast and Schneider 2017).

Assessing relevant ecological, economic, regional development, social, cultural and political dimensions requires deep integration of different actor interests through participatory processes (Reed 2008; Arts et al. 2017). Furthermore, progressing towards sustainable and conservation-oriented landscape management requires analysing both informal dynamics such as current power differentials and interplays on the ground, and within this context, analysing how formal institutions could better enforce agreements, decision-making processes and help to implement adaptive management, ensuring stakeholder involvement and balancing multiple objectives, as per the

principles of sustainable landscape management (Sayer et al. 2013; Reed et al. 2014; Sayer et al. 2015). These governance-related success factors need systematic exploration in a trans-disciplinary setting (Kareiva and Marvier 2012; Ban et al. 2013; Bennett et al. 2016, 2017).

Spatial planning as a key instrument for sustainable landscapes

Spatial planning can play an important role in making sustainable landscapes a reality (UNECEC 2008). Indeed, for many conservation practitioners spatial planning and landscape planning are one and the same (Sayer et al. 2013). Best practices in spatial planning aim to develop a realistic long-term vision and frameworks for action with citizens that consider multiple scales, balancing competition amongst values such as recognising power structures, and ultimately focusing on ‘real world’ resource allocation decisions (Albrechts 2004). Led by the public sector, spatial plans are mostly legally binding instruments. The nesting of local land use within national- and regional-level strategic spatial planning implies that legal instruments like regulatory zoning can be used to adapt and change land use in practice (Albrechts 2004). For these reasons, conservation success at the scale of large landscapes is thought to depend on how well conservation information and goals are embedded in spatial policy processes at multiple government levels (Beunen et al. 2013).

In Indonesia, spatial planning has been promoted as an important instrument to govern landscapes for both conservation and development outcomes (McCall 2003; Hudalah and Woltjer 2007; UNECEC 2008; Kelman 2013). Spatial planning policies have recently been established to manage large landscapes for the protection of biodiversity and ecosystem services known as a strategic area for the environmental purpose (Hudalah and Woltjer 2007). In the last 5 years, the Indonesian government has released seven national-level regulations on the spatial planning of islands. One of these regulations focuses on Sumatra and recognises and incorporates the five corridors that constitute the ecological network of the island. The RIMBA corridor (across the provinces of Riau, Jambi and West Sumatera) is one of these corridors.

The RIMBA corridor landscape: an on-going large-scale conservation programme

The RIMBA corridor is located in Central Sumatra (Fig. 1). The corridor connects a network of biodiversity-rich protected areas that are increasingly being fragmented by roads and prone to rapid urban and agricultural

expansion. It is also subject to wildlife poaching and forest encroachment by settler communities living inside or surrounding the corridor.

The main objective of the RIMBA corridor landscape is to ensure the connection of existing protected areas (such as Kerinci National Park, Rimbang Baling Wildlife Sanctuary, Bukit 30 National Park and Berbak National Park) and to protect the habitat of large mammals (such as elephants, tigers) and birds (Sulistiyawan et al. 2017). The area also provides a broad range of ecosystem services, for example, carbon storage, water provision and nutrient retention (Bhagabati et al. 2014; Sulistiyawan et al. 2017). The RIMBA corridor can be recognised into three different ecosystem types according to clusters of programmes interventions. Cluster I is dominated by lowland mineral soil and undulating topography and is covered by lowland forest, often forming a mosaic with oil palm and rubber plantations. Cluster II covers mostly peat-land forest and wetlands, some areas drained by the canals for dry land agriculture such as oil palm and acacia forest plantation. Cluster III is composed of a mountain range with peaks at an altitude of over 800 m above sea level and the land use comprise a national park, protected forest and agroforestry coffee which provides ecosystem services such as water provisioning for micro-hydro and clean water.

The RIMBA corridor has been developed due to strong political support through commitments from governors in Sumatra in recent years. In 2008, ten governors and four ministries together expressed political commitment to protect Sumatran ecosystems and maintain the remaining tropical biodiversity, with the aims of mitigating climate change, halting forest loss and preventing ecological collapse (Barano et al. 2008). This political commitment was formalised in the Presidential Decree No 13/2012 on “Sumatra Spatial Planning and Corridor RIMBA”, declared in article 48 (7b). The RIMBA corridor was then promoted by the Ministry of Public Works and Housing in 2010 when the Sumatra roadmap was launched with the aim of securing the health of Sumatran ecosystems. The RIMBA corridor is supported by the Millennium Challenge Account-Indonesia (MCAI) and WWF Indonesia through its Green Prosperity (GP) programme. The GP programme intends to reduce poverty and promote green economic growth through improved access to clean, reliable and affordable renewable energy and sustainable products of community agroforestry and agriculture, while sustainably managing Indonesia’s natural capital. In addition, the RIMBA corridor is included in the UN

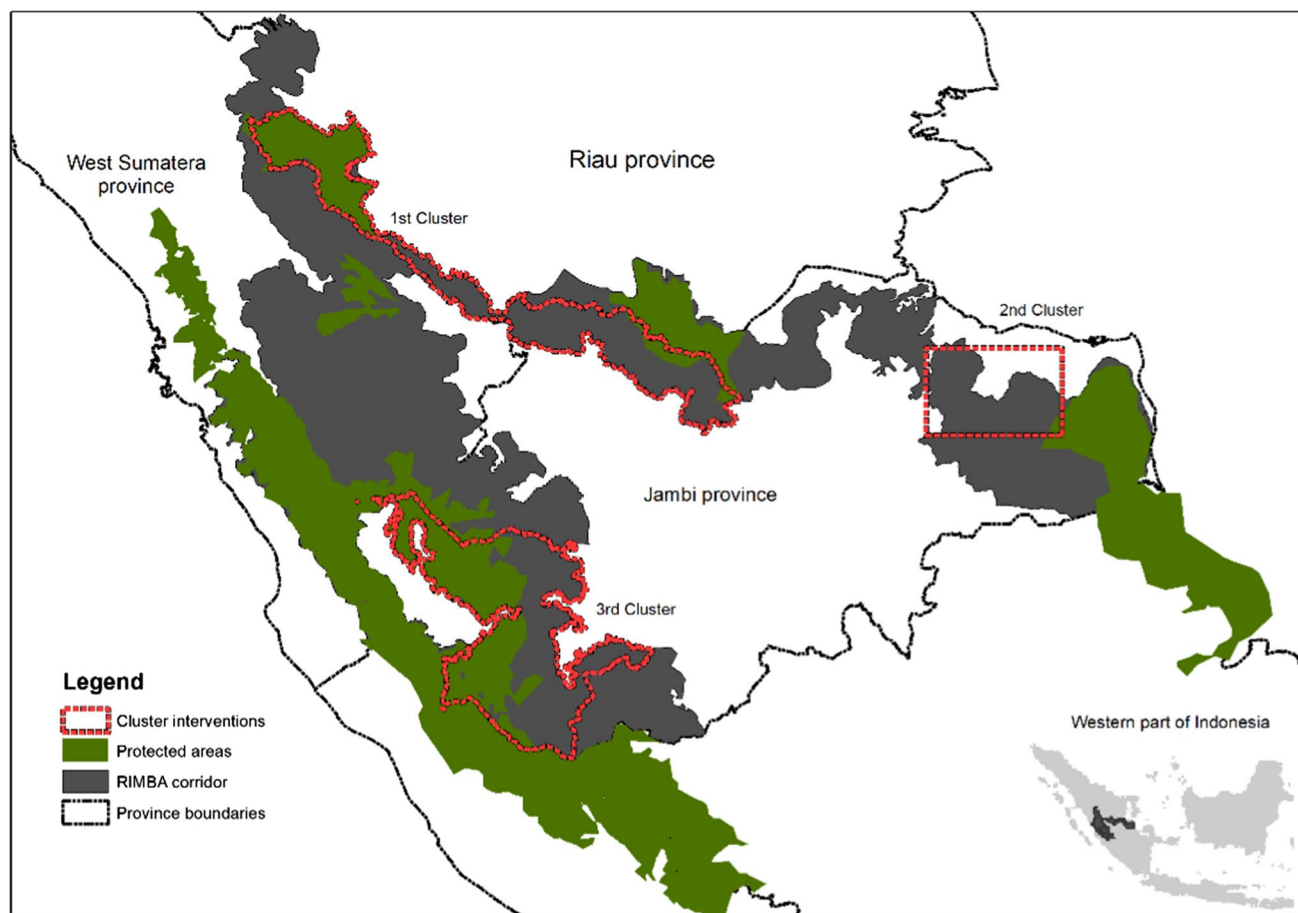


Fig. 1 The case study area of the RIMBA corridor located in three provinces (Riau, Jambi and West Sumatra), consisting of nineteen districts

Environment Programme Global Environment Facility (GEF) as a priority landscape for applying the ‘green economy’ concept.¹ Green economy approaches are used by the Indonesian government to achieve the Sustainable Development Goals (SDGs) (Ministry of Finance 2015). A green economy is defined in this context as an economy that results in “improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcity” (UNEP 2011). The GEF RIMBA programme is in its inception phase, prior to full implementation. Both the MCAI and GEF programmes have the potential to accelerate the conservation of biodiversity and other ecosystem services and to enhance human well-being in the RIMBA corridor, through better planning and ecosystem management.

In each of the three RIMBA corridor’s Clusters, specific activities and pilot projects are already being experimented

as part of the RIMBA programme to enhance biodiversity conservation and sustainable ecosystem services management. Examples include wildlife monitoring (e.g. camera traps, etc.); capacity-building of civil servants in charge of forest management and protection (e.g. creation of Forest Management Units); development of Best Management Practices and certification schemes to improve the sustainability and transparency of rubber and palm oil plantations and supply chains; and development of Non-Timber Forest Products for additional income for local communities.

While the RIMBA ecological corridor is regulated under a Presidential Decree on spatial planning, this policy cannot suffice on its own to govern the multiple unplanned land use changes that will ultimately determine conservation outcomes, and it cannot be a guarantee that the pilot projects currently experimented will scale-up to a sufficient degree to create significant changes (Hudalah and Woltjer 2007). Therefore, important governance questions still remain and need to be addressed.

In this paper, we specifically focus on two of these questions: (1) what are the main governance challenges that the RIMBA corridor programme needs to address to be

¹ UNEP GEF-RIMBA project document (<https://www.thegef.org/project/strengthening-forest-and-ecosystem-connectivity-rimba-landscape-central-sumatra-through>).

successful (i.e. to balance between the provision of sufficient habitat for wildlife protection on the one hand, and allowing a sufficient level of economic productivity to support the various land users living in the landscape on the other hand)? (2) What key elements (regulations, sources of finance, both formal and informal institutional mechanisms, etc.) can be improved to progress towards such a more sustainable and effective governance of the RIMBA corridor landscape?

Methods

Sustainable landscape approaches focus on achieving long-term goals of conservation of biodiversity and ecosystem services, development and livelihoods by engaging and empowering the various groups of stakeholders affected by these changes, and by sharing the benefits produced by the landscape (Estrada-Carmona et al. 2014). These approaches represent an alternative to business-as-usual landscape planning and development where biodiversity and ecosystem services are not taken into account. In this paper, we concur with Sayer et al. (2017), that “process is the main driver of learning and adaptation in the early years of any landscape-scale initiative”, and that six specific criteria are particularly useful to assess the effectiveness of the process of engagement, negotiation and collective development of a stable governance setting among stakeholders: (1) the definition and communication of clear goals; (2) the development of a ‘theory of change’ for how to move from business-as-usual to a more sustainable landscape; (3) a rigorous and equitable process for continuous stakeholder engagement; (4) explicit connections to key policy processes and actors at local, national and global levels; (5) evaluation of the effectiveness of institutions, their connectivity to decision-making, and the extent to which they reflect the views of, and are trusted by, the full range of actors in the landscape); and (6) openness and transparency of the process and building trust (Sayer et al. 2017).

Guided by these six criteria, we used a combination of social science methods to both produce a diagnostic of the main existing governance challenges of the RIMBA corridor landscape, and to identify and put forward actions and institutional design elements needed to address these challenges and progress towards a more sustainable landscape. We used a combination of (1) exploratory stakeholder consultation and engagement methods through intensive Focus Group Discussions; (2) the use of a “context diagnostic approach for conservation” to critically analyse the Focus Group Discussion results and the informal on-going dynamics in the landscape (Feger et al. 2017); and (3) a questionnaire-based survey to collect information on stakeholders’ design option preferences regarding a possible formal institution

to govern the RIMBA corridor (see Fig. 2). Together, these three methods address different dimensions of the conditions under which biodiversity and ecosystem services protection could become an integral part of the landscape development, which is a central element of its sustainability.

Focus Group Discussions

Five Focus Group Discussions (FGDs) were held, including five key groups of stakeholders in chronological sequence: (1) Forest Management Units; (2) local community representatives; (3) businesses and economic sectors (agriculture, tourism, etc.); (4) provincial and district planning and development agencies; and (5) national government institutions and relevant ministries. The FGDs were conducted over a period of 5 months (October 2016–February 2017), and each event lasted 2 days. Overall, the FGDs gathered a total of 356 participants (279 men and 77 women). The facilitators were members of the WWF staff and independent external experts. The FGDs were crucial to engage stakeholders and identify in a qualitative manner the challenges they face in relation to the establishment of the RIMBA corridor, the roles they (could) play in governance, and the possible solutions that could be supported by the RIMBA programme (see Supplemental Material in Appendix 1).

For each stakeholder group, we used five sets of questions to frame the Focus Group Discussions. Each of the five groups of stakeholders was divided into smaller groups to discuss the questions successively in relation to their everyday activities. Each set of questions focuses on particular dimensions of the landscape’s formal and informal governance:

- What is the state of awareness and knowledge on issues related to biodiversity and ecosystem services?
- Who are the key actors who can enable change towards a more sustainable landscape, or on the contrary, who represent an obstacle to such change? What is the extent of their influence and power?
- What innovative solutions could help realising the local stakeholders’ own livelihoods and development goals, while at the same time benefitting biodiversity and ecosystem services to a significant ecological scale? What are the requirements for their successful adoption?
- What sets of (social, economic, cultural, political, etc.) values are held by each stakeholder and how do these values conflict or combine with one another in a way that can influence land use and management practices?
- What institutional dynamics regulate the ability of local communities living in or around the corridor to access and create value from natural resources, biodiversity and ecosystem services?

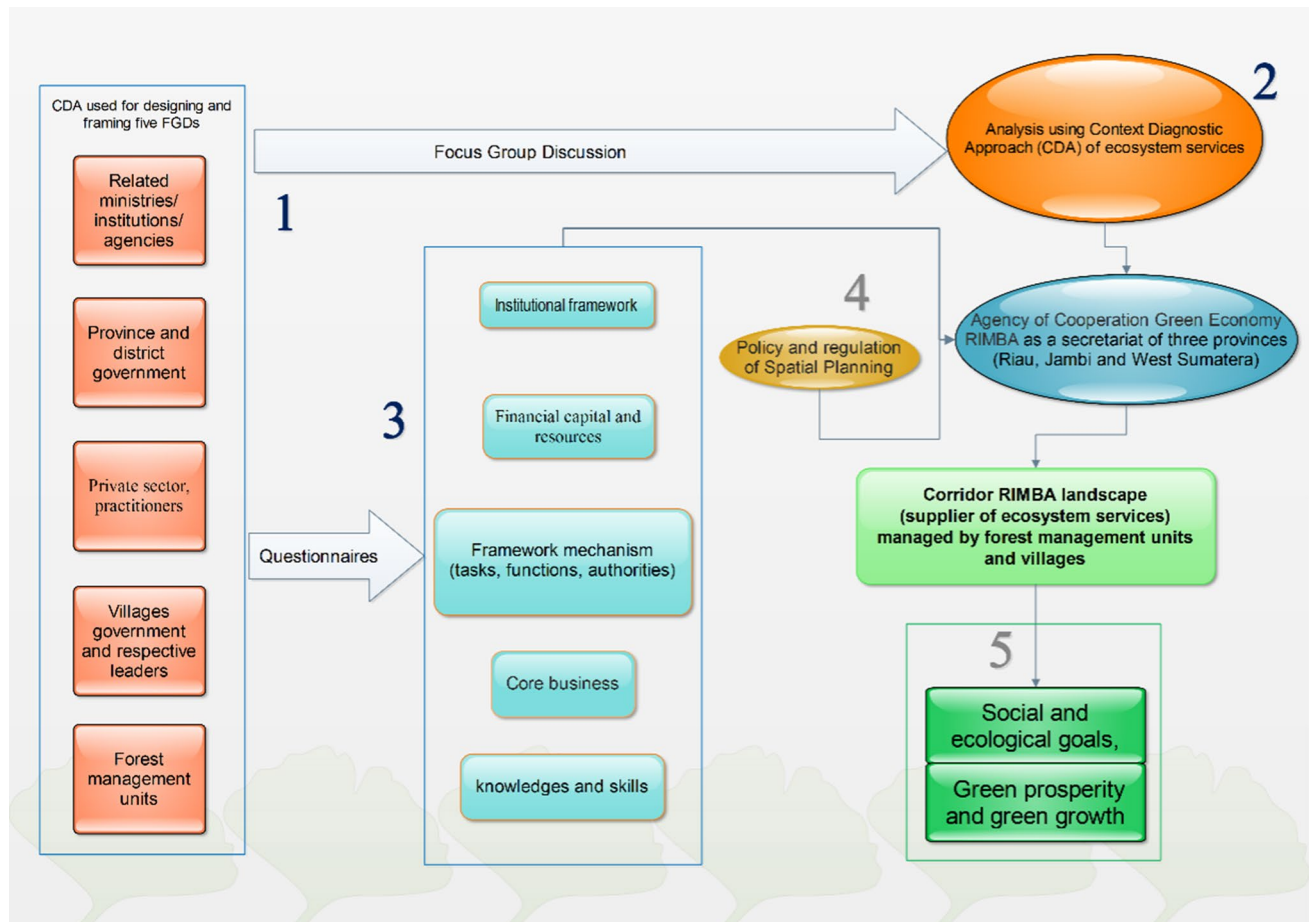


Fig. 2 Steps in the diagnostic of main governance challenges and identification of options for interventions. Steps 1, 2 and 3 refer to methods for data gathering and analysis using the Context Diagnostic Approach for Conservation (CDA) to develop RIMBA corridor gov-

ernance. Step 4 refers to complementary analysis, using the result of CDA in the further process and step 5 refers to the set of goals that should be achieved in the landscape

The qualitative information was coded into two main categories. In the first category, we identified the problems currently faced or anticipated by stakeholders in the implementation of the RIMBA corridor programme, as well as the current governance challenges pointed out by the different groups. In the second category, we identified the ideas put forward by the different groups of stakeholders to enhance the programme implementation as well as the opportunities pointed out to improve landscape governance. This classification was made for each of the five groups of stakeholders who participated in the five distinct Focus Group Discussions (Table 2 and detailed in Appendix 1). In each category and for each group, the main issues were underlined as well as the specific issues regarding resources and capacity building.

Analysis through a theory-based context diagnostic approach

We used the Context Diagnostic Approach for Conservation (CDA) to analyse both the information collected through the FGD as well as the expert team's experience in the early-stage implementation of the RIMBA programme (Feger et al. 2017; Gallagher et al. 2017). The questions used to facilitate the FDG were based on the five-step approach of the CDA. After the FGDs were held, in-depth discussions were conducted using the CDA with ten members of local WWF teams involved in the FDGs RIMBA activities for several days in February 2017. This step further developed the diagnostic of the current dynamics of

change already initiated by the RIMBA programme and identified remaining salient governance challenges and opportunities to overcome them.

The CDA method was developed by researchers from AgroParisTech, Cambridge University, WWF, and the Natural Capital Project (a partnership of Stanford University, WWF, The Nature Conservancy, the University of Minnesota and the Chinese Academy of Sciences) and is described in more detail in Feger et al. (2017). The method provides a structured, theory-based approach to analyse a given conservation intervention (in our case, the RIMBA corridor) through collective brainstorming among knowledge domain and conservation practice experts. ‘Hidden’ knowledge and underlying assumptions are surfaced and tested through questioning: (1) the social and political awareness and maturity of conservation issues in the landscape; (2) the power relations among stakeholders; (3) the roles of innovative solutions and their chances to be adopted at a significant scale; (4) the interplay of different value systems; (5) and the institutional dynamics that regulate local community’s livelihoods depending on natural resources.

To guide the collective reflection and analysis around these questions, experts use visual diagrams with accompanying check-lists of questions, organised and rooted in well-established social science theories described in Table 1.

A questionnaire to explore stakeholders’ institutional design preferences

Some FGD participants also took part in a survey using questionnaires to gather input on their preferences for a new system of landscape governance. The questionnaire was distributed to all participants. Only completed questionnaires were collected which resulted in 160 individual responses (a response rate of 100%). The questionnaire covered five key institutional elements of spatial planning identified by the Ministry of Agrarian and Spatial Planning (MoASP). The questionnaire objective was to reveal respondents’ preferences on five elements of landscape governance, as outlined by MoASP. The questionnaire was divided into six parts. The first part elicited respondent demographic characteristics (age, gender, etc.). The second part covered the respondents’ views on the appropriate level of regulation (at national and sub-national levels). The third part elicited respondent views on the functions, tasks, roles, level of authority, and location of the future institution(s) specifically designed for the coordination of the RIMBA corridor landscape. The fourth part queried preferred options for funding and financial support. The fifth part related to preferences for the main green economy activities supported by the RIMBA corridor programme (eco-tourism; Best Practices Management in supply chains, etc.). The final section pertained to

respondent understanding of the skills, knowledge and competencies necessary to manage ecosystem services under the institution of RIMBA corridor.

The results were analysed with statistical software, employing frequency counts and linear regression analysis to understand the distribution of respondent preferences across our sample and exploration of preferences for potential legal framework development establishing an institution for cooperation on a green economy (ICGE), including determination of the eventual ICGE function, tasks and authority. The regression analysis was used to analyse relationships between variables of this legal umbrella from the perspective of respondents’ preferences. An analysis of the relation between the mean value of legal umbrella (e.g. Presidential Decree, local regulation and village regulation) and corresponding values of respondents preference (e.g. strong regulation, integrative and quick in the process). The full set of questions and results are included in the supplementary material (see Appendix 2).

Results

The results are presented in three parts: main governance challenges and opportunities surfaced by the Focus Group Discussions; analysis of these challenges based on the context diagnostic approach; and analysis of respondent questionnaires.

Challenges and opportunities in achieving sustainable landscape governance

The main problems identified in the five successive 2-day Focus Group Discussions pertained to the weak institutionalisation of the RIMBA corridor programme, including limited institutional legitimacy and authority to govern the RIMBA corridor given the weak legal framework and regulations. The current institutions mainly focus on the jurisdiction and tasks within their field of competency/specialisation, which are sectorally organised. Conventional practices related to commodities, such as producing, harvesting, processing, packaging and marketing are maintained, with little room for innovation. This condition is also reflected by an existing trading system with strong inequalities between farmers and traders. Social conflicts over land tenure were identified within local communities due to immigrants occupying land and extending agricultural area into protected areas. Some of the most salient issues identified include: (1) insufficient financial support to the Forest Management Units in charge of controlling and enforcing the law on forestland; (2) lack of human capacity, skills and knowledge for farm management, which limits the ability to introduce innovative sustainable practices among farmers; (3) limited prospects for

Table 1 Five dimensions of intervention context and design including theory for analysis (adapted from Feger et al. 2017)

Dimension of the RIMBA intervention context to analyse	Dimension of the RIMBA intervention design to reflect on	Theory by which the analysis is inspired
Among key actors and the population, what is the level of awareness of the ecological issues the RIMBA corridor landscape aims to address? At what stage are we in the process of change?	What next steps should be taken by the RIMBA programme to reflect the current stage in the process of change?	Politics of Nature. How to Bring the Sciences into Democracy. Latour (2004)
What is the reality of the power relationships between the coalition of actors who back the RIMBA programme's environmental goals, and other actors who prioritise other goals?	How can we improve the strategic development of the RIMBA corridor programme and activities that promote change in actions among those who adversely impact biodiversity and ecosystem services?	Strategic Environmental Management Analysis Mermet, (2011), Mermet and Leménager (2015) and Leroy (2006)
To what extent can the biodiversity-friendly solutions and innovations promoted by the RIMBA programme be compelling enough to other stakeholders to be adopted and create significant changes?	How can we improve the chance of the innovations and solutions being adopted by the relevant stakeholders at a significant scale?	Sociology of Translation/Actor Network Theory (Callon 1986)
What are the values used by various stakeholders to justify their behaviour, proposals and actions when dealing with biodiversity and ecosystem services issues addressed by the RIMBA programme, and when engaging in its activities?	How can we better frame the values put forward by the RIMBA landscape programme to gain traction among the stakeholders involved who hold multiple contradictory orders of value?	The Economics of Worth (also known as Justification theory) Boltanski and Thévenot (2006)
How are (formal and informal) institutions and available infra-structures conditioning local communities' access to, and control over, natural resources for their livelihoods?	How can the RIMBA corridor landscape programme help to renegotiate institutions and rules in a way favourable both to natural resources conservation and to local communities' well-being?	Environmental Entitlements Framework and Common-Pool Resources theory Leach et al. (1999) and Ostrom (1990)

Table 2 Stakeholder analysis of five Focus Groups Discussion (FGD), the current barriers to change and effective governance and possibilities identified by stakeholders to overcome the current barriers to change and good governance

FGDs	The current barriers to change and effective governance		Possibilities identified by stakeholders to overcome the current barriers to change and good governance	
	Issues	Resources	Issues	Resources
Ministry of Environment and Forestry, Forest Management Units October 2016—90 participants (divided into three groups)	<p>The transformation from district to province to a new governance system of the FMU is already processing for 2 years in the transition period</p> <p>The FMU is lack of legitimacy</p> <p>Inadequate financial support to FMU</p> <p>Lack of knowledge of business models (NTPPs, ecosystem services)</p>	<p>Inadequate financial support</p> <p>Lack of capacity and number of staff</p> <p>Lack of equipment, infrastructure</p> <p>Lack of conflict management</p>	<p>Establishment of a collaborative institution for RIMBA management</p> <p>Better management of land degradation</p> <p>Better knowledge of sustainable business models</p>	<p>Forming consortium of FMUs</p> <p>Young employees with high commitment</p>
Local communities (not including recent settlers) October 2016—80 participants	<p>Unfair commodity prices</p> <p>Low product quality and quantity due to lack of capacity on farm management</p> <p>Social tension from immigrant groups</p>	<p>Low skills to produce more products with better quality</p> <p>Low diversity in products</p> <p>Low negotiation skills with middlemen</p>	<p>Diversifying income through multiple land uses</p> <p>Improving quantity and quality of commodities</p>	<p>Better and fair commodity prices</p>
Regional business November 2016—40 participants	<p>Farmers cannot comply to production standards</p> <p>No processing for home industry (such as rubber, coffee)</p> <p>Some policies prevent sustainable business solutions such as ecotourism</p>	<p>Lack of farmer skills</p> <p>Lack of infrastructure (tourism)</p> <p>Lack of law enforcement on illegal land conversion</p>	<p>Processing industry demand for stable prices and quality</p> <p>Traceability of illegal activities</p> <p>Enhancing prospects for eco- and cultural tourism</p>	<p>Branding, advertising, awareness raising</p> <p>Education schemes</p>
Local government January 2017—60 participants	<p>Lack of political will to enforce sustainable options and green economy</p> <p>Weak governance to control resources and to address a complex issue</p> <p>Weak communication and negotiation skill on green economic</p>	<p>Inefficient use of resources (land)</p> <p>Weak capacity of staff</p> <p>Limited market access and knowledge</p>	<p>Creating a 'RIMBA brand' to support sustainable supply chains</p> <p>Improving local trading systems</p> <p>Strengthening green economy knowledge</p>	<p>Authority to implement plans</p> <p>Strategic plans and regulations for different agencies</p>
National government February 2017—58 participants	<p>Unsuitable RIMBA corridor landscape management on short-term period, it should be at medium and long-term programmes</p> <p>Too wide array of responsibilities of different agencies, jurisdictional and sectoral approach</p>	<p>Lack of institutions to implement green economy</p> <p>Lack of skills to take up complex issues</p>	<p>Installing formal institution to sustainable development in the RIMBA corridor</p> <p>Improved green economy, including tourism, NTPPs and commodities</p>	<p>Management and control by governmental agencies</p>

tourism due to weak infrastructure and hotel accommodation; (4) weak negotiation and communication skills of local authorities; and (5) low capacity to address complex and time-consuming issues such as providing guidance on the adoption of more sustainable practices to local communities and farmers. The FGDs also helped to identify possible ideas and opportunities to overcome these identified barriers (Table 2).

Analysing five key dimensions for the sustainable governance of the landscape

“Narratives embody values, ideas and power” (Lowndes and Roberts 2013:63) and the Context Diagnosis Approach assists in surfacing stakeholder reflections on social and political relations as they understand them (Feldman et al. 2004). Qualitative data from the FGDs and expert discussions of on-going field activities and dynamics were analysed across the five key dimensions to assemble major narratives describing RIMBA corridor governance and programme implementation (to end 2017) and how it is evolving, in their opinion.

Level of political and social awareness of ecological issues

Awareness of deforestation and habitat fragmentation is already quite significant among stakeholders. For example, there is a legal recognition of the RIMBA corridor and its spatial boundaries as a landscape-scale conservation intervention, funding schemes are in place to finance RIMBA programme activities, and there is increasing local awareness of some of the adverse consequences of deforestation such as fire hazards and smoke. In addition, some of the proposed RIMBA activities are already being implemented by a small group of local farmers, households and non-profit organisations such as the production of high quality and sustainable commodities, the experimentation with non-timber forest products by local communities (e.g. honey), and wildlife monitoring. However, the level of awareness about the ecological issues and their current and future adverse consequences has not yet been sufficient to trigger large-scale negotiations on the trade-offs and the costs that each stakeholder would be ready to bear in order to create significant change in deforestation trends.

The activities and solutions promoted by the RIMBA corridor programme to halt deforestation and habitat fragmentation are still at the pilot project stage and not yet ready to be institutionalised at large scales. Stakeholders repeatedly identified the need for increased awareness about the adverse consequences of deforestation for progress towards scaling and institutionalisation of sustainable practices in the RIMBA corridor.

An intensification of field experiment and pilot projects is needed to demonstrate success and encourage replication. There is scope to extend RIMBA programme’s consultation activities to a wider range of stakeholders that have not yet had a voice even though they are key to the success of the programme. For example, two significant gaps are the non-native oil palm and rubber farmers who encroach on forestland and large, price-setting buyers of rubber and oil palm products). These avenues are ready to be pursued until serious negotiations can be triggered on how to scale-up the pilot solutions to the whole RIMBA corridor area to more effectively tackle ecological and livelihood issues.

Power and strategic relationships among stakeholders

The CDA analysis of stakeholder feedback reveals opportunities to create synergies and coalitions between (1) civil society actors and environmental NGOs; (2) motivated village leaders and farmers involved in the programme’s Best Management Practices; (3) public entities favourable to RIMBA’s objectives such as the Ministry of Agrarian and Spatial Planning, the Ministry of Forestry and Environment and the Ministry of Economic Affairs; (4) the recently created local Forest Management Units in charge of securing good forest management; and (5) the few companies that have adopted environmental standards (such as RSPO and FSC members). However, these synergies will remain pointless if nothing is done to reduce the influence of the powerful coalitions that also exist between the actors who are responsible for the on-going forest degradation dynamics in the corridor landscape.

The environmental degradation results from several processes. Native and non-native smallholder groups are converting forestland into oil palm plantations and engage in illegal logging and mining, or causing fires on peat lands. Local and national agricultural public entities or some individual politicians support high levels of unsustainable agricultural productivity by providing financial and material support to farmers, as well as passing or maintaining unfavourable regulations and issuing concessions on forest and peat lands. Unsustainable companies and middlemen are facilitating access to forestland to newcomers.

The analysis concluded on the need to pursue the development of collaborations and partnerships around the RIMBA programme and its explicit conservation and livelihood goals, while at the same time testing the real motivation of business actors and local public agencies who directly or indirectly encourage deforestation, and what would be needed for them to commit to curbing business-as-usual dynamics, transforming existing regulations that have adverse environmental effects, increasing monitoring activities and control of illegal activities

Table 3 Requirements identified by stakeholders during the five FGDs to increase the chances of adoption of the solutions and innovations promoted by the RIMBA programme

Stakeholders	Requirements highlighted by stakeholders to increase the chances of successful adoption of RIMBA programme's biodiversity-friendly innovations
Forest Management Units (KPH) for the Production Forest (KPHP) and Protected Forest (KPHL)	Facilitate development of a business plan on non-timber forest products and ecosystem services Develop business cases and strengthen the link with the market to support community production from multi-purpose trees Obtain local community support for KPHP/L existence
Village government	Lower production costs and achieve higher and more stable prices for sustainably grown commodities (such as organic product, zero waste management) Stabilise land use and control forest conversion through local systems of accountability, and identify illegal plantations to mitigate extension of encroachment Support local leadership in overcoming land use disputes between native citizens and citizens coming from other districts and provinces Co-decision support system between formal and informal institutions such as village leader government and customary leader through "Badan Musyawarah Nagari": a village leaders consultation forum
Green business	Implement traceability and visibility of certification schemes to ensure that commodities purchased from farming communities are sourced from legal plantations and reduce business reputation risks Ensure a stable supply of commodities both in quantitative and qualitative terms
Local government	Provincial and district spatial planning regulation (Rencana Tata Ruang Wilayah Propinsi/Kabupaten—RTRWP/K) and regional medium-term programme development (Rencana Pembangunan Jangka Menengah Daerah—RPJMD) to explicitly recognise and accept the importance of the RIMBA corridor for achieving Sustainable Development Goals (SDGs) at district and province levels
Central government	RIMBA corridor initiative should be considered a long-term programme and not a short-term project Institutionalise the RIMBA corridor based on a robust model to face current and future challenges

through the development of 'environmental intelligence', and increasing the capacity of Forest Management Units for effective law enforcement against forestland encroachment and conversion.

Implementation of biodiversity-friendly solutions and innovations

For the biodiversity-friendly solutions promoted by the RIMBA programme to have a chance to be adopted by stakeholders, they should fulfil stakeholders' needs in a better way than their current business-as-usual practices and activities. The innovations and solutions promoted by the project for instance include sustainable coffee, certification of palm oil and rubber, accompanied by land access restrictions. The solution has a chance to succeed in generating its biodiversity and ecosystem services protection effects if enough stakeholders gradually consider it as a 'compelling passage point' for them to pursue their own goals and livelihoods (Callon 1986). Table 3 summarises the key requirements for RIMBA's governance and activities to increase the chances of adoption of the solutions the programme seeks to promote, as identified by stakeholders.

Conflicting values and value compromises among stakeholders

Applying stakeholders value analysis of CDA, the analysis demonstrates how the RIMBA corridor programme's theory of change, as recounted by the stakeholders, is based on a combination of (a) 'industrial' value, i.e. Best Management Practices will optimise the technical and economic value of rubber and palm oil environmental quality, (b) 'reputation' value, i.e. these practices will increase the reputation of business buyers and provincial government, and (c) 'market value', i.e. new sustainable practices will provide a competitive advantage to local farmers and their business and public partners.

Given the peripheral status of 'civil' values on the ground (i.e. there is a lack of law enforcement and a general tolerance of land encroachment both by local communities and public institutions) and because of the weakness of 'environmental' values (i.e. there are few actions and statements from local communities that are motivated primarily by the needs of caretaking of nature and forests), the project's future chance of success is possibly compromised in its current formulation. RIMBA needs to compete with a strong business-as-usual value system in which 'market' values are

combined with ‘industrial’ values, such as effectiveness and efficiency in unsustainable crop production, and ‘domestic’ values such as traditional values and family practices. In many cases, customary institutions still exist and have a strong influence on land use change decisions of the village government. Indeed, native farming communities use customary laws (the ‘*Adat*’ system) to justify the acquisition of new forestland and sell it for conversion—or convert it themselves—into oil palm plantations while using government subsidies and materials to optimise production on their unsustainable plantations and gain competitive advantage.

Stakeholders point to a need for clarifying the interplay between traditional practices of collective land management and civic law enforcement in controlling access to protected forests. A priority action highlighted was to demand more accountability from local communities regarding their activities in forestland. Finally, increasing awareness by making a stronger case for increased effectiveness of the RIMBA green economy approach, compared with business-as-usual practices, in creating long-term economic, social and environmental value.

Formal and informal institutions mediating local communities’ well-being

Each of the three groups of local communities identified institutional and infrastructure changes and innovations that could be promoted by the project to address well-being and livelihoods issues. The formal and informal institutional innovations and infrastructures described in Table 4 are suggested by stakeholders to facilitate communities’ access and control over natural resources and ecosystem services while developing their capacity to derive a collective or common value for their livelihoods through (new) sustainable value chains.

Understanding stakeholder preferences for institutional design

The survey questionnaires were completed by a total of 160 individual respondents in the focus groups, from different gender, educational backgrounds and job status (Appendix 2, Table 1). The questionnaires were used to identify stakeholders’ preferences regarding five key institutional elements identified by MoASP (see above, analysis results in Appendix 2, Figs. 1, 2, 3 and Tables 2, 3, 4). For instance, 94% of respondents thought that a formal institution of cooperation needs to be developed as part of the RIMBA corridor governance system (Appendix 2, Fig. 1). To ensure a strong legal hierarchy, 61% of the respondents chose an appropriate legal umbrella, enforced by a Presidential Decree at the national level to govern three provinces. 26% of the respondents thought regulation

should be at the provincial and district level to allow faster processing and better integration across local government agencies. 6.3% of respondents thought village regulation is also required to align with the national and local level and to ensure local communities are an integral part of the management of the RIMBA corridor (see Appendix 2, Table 2).

In terms of the functions, tasks, and authorities of the needed coordinating institution called “Institution for Cooperation and Green Economy RIMBA” (ICGE), respondents gave the highest priority to the following: (1) facilitation of problem solving at an inter-provincial spatial planning level in the RIMBA corridor; (2) alignment of activities with spatial planning at provincial and district levels; (3) fundraising activities for promoting featured products from Forest Management Units in the RIMBA corridor. Respondents emphasised that the ICGE Secretariat must understand the complexity of the local land tenure situation.

There was support for a Secretariat of the ICGE RIMBA in each province that would facilitate joint discussions among Forest Management Units, villages and governmental agencies to produce shared work plans, programmes and budgets. Respondents also provided inputs on funding mechanisms and identified needs to support the operations of ICGE RIMBA (see Appendix 2, Fig. 2, Table 3 for more detail). Knowledge of environmental management, economics and tourism management were highlighted as priorities for ICGE’s capacity.

Regarding the core business of ICGE, the respondents expected the ICGE to facilitate Best Management Practices schemes and adapt it to the variety of land use functions and sectors that are found across the landscape. Furthermore, respondents indicated that they wish the ICGE to be able to develop a chain of custody to control the legal sourcing of the products as well as fair trade mechanisms that encourage change. Respondents also want ICGE to be able to develop and promote ecotourism activities and amenities. Moreover, respondents insisted on the need for the ICGE to support the growth of a creative industry involving non-timber products, arts, and cultural attractions at the household level and beyond. Finally, the ICGE should promote and create a branding of the RIMBA corridor landscape as a green landscape to enhance the competitiveness of sustainable products (see Appendix 2, Table 4).

The respondents believe that in order to deliver this kind of support and coordination, the ICGE should have the skills and capacity for diplomacy both at the national level and international level, for lobbying, negotiating, and mediating conflicts among land users, traders and business practitioners. Furthermore, the ICGE staff should have a high level of expertise as well as technological equipment to effectively support sustainable activities throughout the whole RIMBA corridor landscape area (see Appendix 2, Fig. 3).

Table 4 Possible institutional and infrastructure innovations within the RIMBA programme, as a result of the FGDs with villages and Forest Management Units

Location of RIMBA programme activities	Institutional and infrastructure innovations needed for <i>improving communities' access to and control over ecosystem goods and services</i>	Institutional and infrastructure innovations needed to <i>transform the ecosystem goods and services into value for livelihoods</i>
<p>Cluster I: Nagari Sipangkur, Nagari Batu Rijal, Nagari Siguntur, Nagari Sitiung, Nagari Sei Duo, Nagari Koto Ranah, Nagari Koto Baru</p> <p>Commodities from land uses such as oil palm plantations, paddy fields, rubber plantations, orange plantations, and lime plantations are the main sources of income. Oil palm, rubber and rice production generate the largest share of income</p> <p>Cluster II: Village Rawasari (Desa Rawasari), Koto Kandis, Catur Rahayu, Manis Mato, Londerang, Rondang</p> <p>Fisheries are the main source of environmental goods for producing salted fish, as well as the nursery of Jelutong trees, pineapple, and a mat handicraft from marsh grass, sago palm, sweet potato and yam</p> <p>Cluster III: Nilo Dingin village (Desa Nilo Dingin), Desa Tanjung Mudo, Desa Tuo, Desa Tanjung Alam, Desa Air Bersih</p> <p>The environmental goods that are primary income sources are Robusta coffee, potato, sugar palm, patchouli oil, avocado, cinnamon, wild honey. There is potential for micro-hydro-power</p>	<p>Arrangements to be negotiated between local populations and Forest Management Units regarding the regulation of their access to forestland</p> <p>Enable communities to manage and use their resources sustainably by providing them with skills and materials</p> <p>Improve skills and/or modernise the methods for sustainable fishing</p> <p>Identify suitability of the soil types for wetland agriculture</p> <p>Diversify food sources through yam, sweet potato and sago cultivation</p> <p>Collect wild honey through sustainable harvesting</p> <p>Apply best practices for vegetables and agroforestry products, combined with planting multi-purpose trees (such as avocado, sugar palm, cinnamon) for forest restoration</p>	<p>Establish sustainable farmers working groups or farmers associations to increase bargaining positions with middlemen and gain government support for more sustainable goods</p> <p>Identify new commodity markets, develop a marketing strategy for sustainable product promotion, and establish secure links with markets to stabilise communities' income</p> <p>Enhance a home industry to produce mat handicraft from marsh grass using sustainable harvesting techniques</p> <p>Improve community skills on post-harvesting techniques to produce good coffee beans</p> <p>Establish micro hydro power plants to obtain sustainable energy for supporting household production such as coffee bean dryers</p>

Discussion

Our results add to the literature on sustainable landscape approaches by providing insights into governance arrangements in support of the maintenance of biodiversity and ecosystem services and economic and development objectives. The success of landscape governance arrangements is strongly contextual and depends on the level of leadership, cross-level institutions, multiple stakeholders, stakeholders' commitment on long-term visions, clear common objectives, sufficient resources, and institutional capabilities, which is in line with Sayer et al. (2015). Our analysis not only focuses on current institutional capabilities and informal dynamics but also points at the need for a new umbrella institution to enhance ecological connectivity in the landscape as a coordinated effort across provinces, integrating multiple levels of governance, multiple actors and multiple sectors. The development of a joint secretariat of three provinces was perceived as a prerequisite to govern the RIMBA corridor landscape, to support the current positive dynamics and expand it to a scale sufficient to counterbalance business-as-usual dynamics and create significant change towards sustainability by substantially integrating biodiversity and ecosystem services protection in development plans.

Indeed, 94% of FGD participants and questionnaire respondents encouraged the institutionalisation of the RIMBA corridor to progress towards more effective governance that can ultimately lead to measurable ecological and livelihoods outcomes. However, there is no available mandatory regulation so far to guide the three provinces and the 19 districts through the complex process of developing, negotiating and establishing a specific institution dedicated to the RIMBA corridor landscape. The current Presidential Decree on Sumatra Island spatial planning regulates the spatial arrangement of three provinces and incites them to integrate ecosystem and wildlife protection in their spatial plans. Nevertheless, it does not foresee the possibility to institute the RIMBA corridor landscape governance into a new institution.

An alternative for institutionalising the RIMBA corridor landscape is through the Law # 23/2014 on local government that provides an option to establish a joint secretariat to address specific issues or tasks. This has been applied in the Batanghari watershed located in the three provinces of West Sumatra, Jambi and South Sumatra. In Jambi province a memorandum of understanding (MoU) has been established with West Sumatra province to manage the upstream watershed area to mitigate negative impacts in terms of surface water runoff, soil erosion and sediment transport in the downstream areas of the Batanghari watershed.

However, challenges remain to be addressed in the current Forest Management Units (KPH) in terms of tasks,

functions, authorities and resources as appeared from the FGD results. We found that the existing institutions in the RIMBA corridor have limited ability to address the cross-cutting issues beyond their jurisdictional authorities. This context is obviously found by other studies that addressed failures of sectoral approaches to engage with environmental losses and habitat damage because there is no clear shared vision on the future of landscapes (Reed et al. 2016; Foli et al. 2017). As each forest management unit has a clearly demarcated authority and a limited level of interventions, the establishment of a consortium of those units was proposed for the RIMBA corridor, which again represents a sectoral approach.

The current institutions are sectorally oriented, lacking the mandate and capacities to refer problems to a higher authority level and the knowledge-transfer systems or networks to share lessons learned with other actors in the region (Hudalah and Woltjer 2007; Kelman 2013). Stakeholders have high expectations for collaboration among villages, private companies and governmental institutions at local and national levels to improve rural populations' livelihoods while limiting forest land-grabbing and addressing lack of political will to provide resources for implementation. The current institutions have mandates to support household creative industries, promote eco-culture tourism, as well as support the production of sustainable commodities. However, they currently fail to act as a catalyst to such collaboration. Establishing trust and functional partnerships between the existing Forest Management Units and village governments is crucial to successfully govern the RIMBA corridor. Other case studies, such as in India, highlighted that arrangements and partnerships between local communities and other agencies are an important aspect to successfully protect biodiversity, as it provides communities more access to forests and recognises the rights to manage biodiversity, forest, and resources use (Gibson and Koontz 1999; Kothari et al. 2013). This could be explored further in the application in Sumatra if the Forest Management Units start collaborating more with village communities.

As revealed by the FGDs in the village context, communities have limited access to financial and technical resources. However, they can support joint decisions addressing local conflicts and promote particular cultural values. This is a form of power, as without community agreement proposed landscape approaches are unlikely to achieve an inclusive and participatory solution and will therefore be counterproductive (Reed et al. 2016). Village governance systems can adopt management systems based on customary law or state law (positive law), or a mix of the two. Although the village governments in the RIMBA corridor generally use state laws to govern their villages, customary institutions are usually involved in decision-making related to natural resources management. This practice is common in other places as

well. For example, in Ghana and Burkina Faso, community forestry is used as an entry point in rural areas to establish and link it to a broader landscape approach to achieve reducing the landscape degradation (Foli et al. 2017).

The questionnaire survey responses highlight the desire to establish a formal institution to facilitate green economy cooperation focused on key management issues in the RIMBA corridor and regulated by a Presidential Decree. This could establish a stronger coordination and governance contributing to effective landscape management. The ICGE RIMBA can fill this capacity gap by Forest Management Units, exemplified by facilitating the communication among Forest Management Units, villages, private sectors and different government levels, to include and promote innovation and market links. Analysing the institutional roles and development of such an institution related to improving sound governance is a pivotal issue in the social–ecological systems as it obtains a clear relationship and the political settings among social, economic and ecological issues. This is highlighted in a French case where farmland development to promote sustainable agriculture was supported and accepted by all stakeholders in a landscape approach bound by regulatory mechanisms (Ban et al. 2013; Bretagnolle et al. 2018).

Another challenge of ICGE is to support existing institutions involved in promoting and developing feasible business models for green economic development such as eco-culture tourism in the RIMBA corridor area. It involves marketing this development as an eco-culture destination and developing the required tourist infrastructure such as accommodation. Other elements of a green economy comprise the improvement to track and monitor raw material from illegal sources along the supply chain, especially for those commodities that have an adverse effect on sustainable land use, e.g. that promote deforestation.

The survey showed that the ICGE RIMBA should address the complexity of the RIMBA corridor as a multi-level and multi-layer management approach. The ICGE needs to engage with multiple levels of decision-making, multiple actors and land users and a diversity of knowledge systems to solve the current natural resource management problems. This concurs with previous studies dealing with complex governance issues, which also required an institutional diagnostic (Angelstam et al. 2013). This type of complex landscape governance by multiple stakeholders requires knowledge management and specific systems of rules and rule-making processes that need to be developed, which is also in line with Ostrom (2009).

The ICGE requires a robust regulation to govern the RIMBA corridor landscape. Its position must not overlap with tasks, functions, and authorities of other existing institutions, as overlapping or contradictory mandates can result in bureaucratic dysfunctional or ineffective institutions (Fukuyama 2013). Funding sources from the national

budget, local governmental budgets, and other sources are pivotal to make planning and managing of the RIMBA corridor a reality. We also identified the need to support business plans that are compatible with biodiversity conservation, which is in line with Reid et al. (2005).

Overall, the results of FGDs, CDA and questionnaires have shown that the applied landscape approach requires dealing with multiple objectives as an entry point to develop a common vision, multi-level governance, stakeholder participation, capacity building and processes towards robust governance. These requirements mirror the ten principles of landscape approaches stipulated by Sayer et al. (2013). Hence, the joint secretariat can be a preliminary institution model of ICGE in the RIMBA corridor landscape to propose a new regulatory mechanism evoking a robust governance model supported by a Presidential Decree.

The CDA analysis helped illuminate the context and the key elements of an institutional arrangement that is needed to govern and manage the RIMBA corridor at the local level. Combined with the FGDs, the approach also helped to identify the key stakeholders and institutions that are willing to support the RIMBA corridor environmental objectives. The tool can be used in different contexts of stakeholder participation and also helped to describe a complex setting from five distinct perspectives and lists of questions useful to portray the current institutions' roles and barriers as well as stakeholder relationships (Feger et al. 2017).

A limitation of our approach was that we did not review the entire policy and regulatory framework, but focused on the most relevant elements. However, our results can be used as a starting point to improve the formal and informal governance of the on-going dynamics in the field that are already part of the RIMBA programme, for further policy studies and to inform the design and development of more adapted institutional mechanisms. It became apparent, however, that coordination is required among the central government (i.e. ministries and other national institutions), provincial agencies and districts to strengthen management of the RIMBA corridor, and enhance partnerships and collaboration among Forest Management Units, villages, customary institutions and private companies. The new envisaged institution ICGE RIMBA can act as a mediator, and as a vehicle for learning processes, communication and monitoring by national, provincial and district agencies. To enhance the connectivity in such a large landscape, stronger modes of governance and coordination are thus required.

Conclusion

This study used an original combination of methods and tools to identify governance challenges and barriers and to develop options to improve the governance structures in

support of sustainable landscapes. Our empirical results point at the various limitations of current institutions that govern the RIMBA corridor and opportunities to create significant changes towards sustainable landscape management. Our research identifies the need for a formal institution of cooperation for a green economy that could take the form of a joint secretariat of three provinces as a preliminary step. The current lack of regulation to create a formal institution of cooperation for a green economy increases the chance of business-as-usual dynamics to prevail. The establishment of such an overarching institution (Institution for Cooperation for a Green Economy, ICGE RIMBA) would instead provide a long-term vision for the RIMBA landscape, promote a multi-level and multi-land user approach and be a catalyzer for the commitments of various institutions to sustainability. Developing this new institution, that could be legitimised by a new Presidential Decree, could encourage the integration of national and local government regulations across jurisdictional scales. This should be done in coordination with the Forest Management Units as well as the village government and customary institutions, in order to guarantee implementation on the ground. However, the key elements and requirements such as an appropriate regulation level, involvement of multi-level institutions, and access to resources, capacity building and feasible green business models still need to be delivered. We believe our approach could be applied in other settings in Indonesia as well as globally to establish effective and contextualised governance modes for management of biodiversity and ecosystem services at landscape scales, including in landscape approaches that include the development of ecological corridors.

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References

- Albrechts L (2004) Strategic (spatial) planning reexamined. *Environ Plan B Plan Des* 31(5):743–758. <https://doi.org/10.1068/b3065>
- Angelstam P, Andersson K, Isacson M, Gavrilov DV, Axelsson R, Bäckström M, Degerman E et al (2013) Learning about the history of landscape use for the future: consequences for ecological and social systems in Swedish Bergslagen. *Ambio* 42(2):146–159. <https://doi.org/10.1007/s13280-012-0369-z>
- Arts B, Buizer M, Horlings L, Ingram V, Van Oosten C, Opdam P (2017) Landscape approaches: a state-of-the-art review. *Annu Rev Environ Resour* 42:439–463. <https://doi.org/10.1146/annurev-environ-102016-060932>
- Ayram C, Camilo A, Mendoza ME, Etter A, Pérez DR, Salicrup DR (2016) Habitat connectivity in biodiversity conservation. *Prog Phys Geogr* 40(1):7–37. <https://doi.org/10.1177/0309133315598713>
- Ban NC, Mills M, Tam J, Hicks CC, Klain S, Stoeckl N, Bottrill MC et al (2013) A social-ecological approach to conservation planning: embedding social considerations. *Front Ecol Environ* 11(4):194–202. <https://doi.org/10.1890/110205>
- Barano T, Mckenzie E, Bhagabati N, Conte M, Ennaanay D, Olwero N, Tallis H, Wolny S, Ng G (2008) Integrating ecosystem services into spatial planning in Sumatra, Indonesia. *Econ Ecosyst Biodivers* 2007(2010):1–5. <https://www.cbd.int/financial/values/indonesia-valuesumatra.pdf>. Accessed 11 Sept 2016
- Beier P, Majka D, Jenness J (2006) Conceptual steps for designing wildlife corridors. *Corridor Des Ariz USA* 269:23784. <http://corridordesign.org/dl/docs/ConceptualStepsForDesigningCorridor.s.pdf>. Accessed 28 Apr 2015
- Bennett G, Mulongoy KJ (2006) Review of experience with ecological networks, corridors and buffer zones. CBD Technical Series no 23. <https://www.cbd.int/doc/publications/cbd-ts-23.pdf>
- Bennett NJ, Roth R, Klain SC, Chan K, Christie P, Clark DA, Cullman G et al (2016) Conservation social science: understanding and integrating human dimensions to improve conservation. *Biol Conserv* 205:93–108. <https://doi.org/10.1016/j.biocon.2016.10.006>
- Bennett NJ, Roth R, Klain SC, Chan KMA, Clark DA, Cullman G, Epstein G et al (2017) Mainstreaming the social sciences in conservation. *Conserv Biol* 31(1):56–66. <https://doi.org/10.1111/cobi.12788>
- Beunen R, Van Assche K, Duineveld M (2013) Performing failure in conservation policy: the implementation of European Union directives in the Netherlands. *Land Use Policy* 31:280–288. <https://doi.org/10.1016/j.landusepol.2012.07.009> (Elsevier Ltd)
- Bhagabati NK, Ricketts T, Sulistyawan TBS, Conte M, Ennaanay D, Hadian O, McKenzie E et al (2014) Ecosystem services reinforce Sumatran tiger conservation in land use plans. *Biol Conserv* 169:147–156. <https://doi.org/10.1016/j.biocon.2013.11.010> (Elsevier Ltd)
- Boltanski L, Thévenot L (2006) On justification: economies of worth. Princeton University Press, Princeton (translated by Porter C)
- Bretagnolle V, Berthet E, Gross N, Gauffre B, Plumejeaud C, Houte S, Badenhauer I et al (2018) Towards sustainable and multi-functional agriculture in farmland landscapes: lessons from the integrative approach of a French LTSER platform. *Sci Total Environ* 627:822–834. <https://doi.org/10.1016/j.scitotenv.2018.01.142> (Elsevier B.V.)
- Brooks JS, Franzen MA, Holmes CM, Grote MN, Mulder MB (2006) Testing hypotheses for the success of different conservation strategies. *Conserv Biol* 20:1528–38. <https://escholarship.org/content/qt70m844q7/qt70m844q7.pdf>. Accessed 03 Mar 2018
- Callon M (1986) Some elements of a sociology of translation: domestication of the scallops and the fishermen of St Brieuc Bay. *Power Action Belief New Social Knowl*. <https://doi.org/10.1111/j.1467-954x.1984.tb00113.x>
- CBD (2015) Biodiversity and the 2030 Agenda for Sustainable Development. <https://www.cbd.int/development/doc/biodiversity-2030-agenda-technical-note-en.pdf>. Accessed 05 Nov 2017

- Chazdon RL (2013) Making tropical succession and landscape reforestation successful. *J Sustain For* 32(7):649–658
- Crooks KR, Sanjayan M (2006) Connectivity conservation: maintaining connections for nature. *Connect Conserv*. <https://doi.org/10.1017/cbo9780511754821.001>
- Cushman SA, Mcrae B, Adriaensen F, Beier P, Shirley M, Zeller K (2013) Biological corridors and connectivity. *Key Top Conserv Biol* 2:384–404. <https://doi.org/10.1002/9781118520178.ch21>
- Estrada-Carmona N, Hart AK, DeClerck FAJ, Harvey CA, Milder JC (2014) Integrated landscape management for agriculture, rural livelihoods, and ecosystem conservation: an assessment of experience from Latin America and the Caribbean. *Landsc Urban Plan* 129:1–11. <https://doi.org/10.1016/j.landurbplan.2014.05.001> (Elsevier B.V.)
- Feger C, Mermet L, McKenzie E, Vira B (2017) Improving decisions with biodiversity and ecosystem services information: a theory-based practical context diagnostic for conservation—Technical Background Paper. http://valuing-nature.net/sites/default/files/images/Context/Diagnostic/Technical/Paper/March/2017_compressed_0.pdf. Accessed 07 Nov 2017
- Feldman MS et al. (2004) Making sense of stories: a rhetorical approach to narrative analysis. *J Publ Adm Res Theor* 14(2):147–170. <https://doi.org/10.1093/jopart/muh010>
- Foli S, Ros-Tonen MAF, Reed J, Sunderland T (2017) Natural resource management schemes as entry points for integrated landscape approaches: evidence from Ghana and Burkina Faso. *Environ Manag*. <https://doi.org/10.1007/s00267-017-0866-8> (Springer US)
- Folke C, Hahn T, Olsson P, Norberg J (2005) Adaptive governance of social-ecological systems. *Annu Rev Environ Resour*. <https://doi.org/10.1146/annurev.energy.30.050504.144511>
- Fukuyama F (2013) What is governance? Working paper 314 January 2013, pp 1–22
- Gallagher L, McKenzie E, Feger C, Sinnott E, Mermet L, Vira B (2017) Creating successful valuing nature initiatives: a guide to analysing local context and developing strong theories of change. *Luc Hoffmann Inst WWF*. <https://doi.org/10.13140/rg.2.2.30859.39207>
- Gibson CC, Koontz T (1999) When ‘community’ is not enough: institutions and values in community-based forest management in southern Indiana. *Organometallics* 18(15):2731–2733. <https://doi.org/10.4103/0972-4923.110937>
- Hudalah D, Woltjer J (2007) Spatial planning system in transitional Indonesia. *Int Plan Stud* 12(3):291–303. <https://doi.org/10.1080/13563470701640176>
- Kareiva P, Marvier M (2012) What is conservation science? *Bioscience* 62(11):962–969. <https://doi.org/10.1525/bio.2012.62.11.5>
- Kelman CC (2013) Governance lessons from two sumatran integrated conservation and development projects. *Conserv Soc* 11(3):247. <https://doi.org/10.4103/0972-4923.121028>
- Kenward RE, Whittingham MJ, Arampatzis S, Manos BD, Hahn T, Terry T, Simoncini R, Alcorn J (2011) Identifying governance strategies that effectively support ecosystem services, resource sustainability, and biodiversity. *Proc Natl Acad Sci* 108(13):5308. <https://doi.org/10.1073/pnas.1007933108>
- Kothari A, Camill P, Brown J (2013) Conservation as if people also mattered: policy and practice of community-based conservation. *Conserv Soc* 11(1):1–15. <https://doi.org/10.4103/0972-4923.110937>
- Latour B (2004) *Politics of nature: how to bring the sciences into democracy*. Harvard University Press, Cambridge
- Leach M, Mearns R, Scoones I (1999) *Environmental entitlements: dynamics and institutions in community-based natural resource management*. *World Dev* 27(2):225–247
- Lebel L, Anderies JM, Campbell B, Folke C (2006) Governance and the capacity to manage resilience in regional social-Ec. *Mar Sci Fac Scholarsh* 11(1):19
- Leroy M (2006) *Gestion stratégique des écosystèmes du fleuve Sénégal—actions et inactions5 publiques internationales*. L’Harmattan, Paris
- Lowndes V, Roberts M (2013) *Why institutions matter: the new institutionalism in political science*. Macmillan International Higher Education, London
- McCall MK (2003) Seeking good governance in participatory-GIS: a review of Processes and governance dimensions in applying GIS to participatory spatial planning. *Habitat Int* 27:549–573. [https://doi.org/10.1016/S0197-3975\(03\)00005-5](https://doi.org/10.1016/S0197-3975(03)00005-5)
- Mermet L (2011) Strategic environmental management analysis: addressing the blind spots of collaborative approaches. *Iddri Pour Le Débat* 11:5
- Mermet L, Leménager T (2015) *Development and biodiversity: navigating the environmental turning point*. Agence Française de Développement, Paris. <http://www.afd.fr/jahia/webdav/site/afd/shared/PUBLICATIONS/RECHERCHE/Scientifiques/Recherches/04-VA-Recherches.pdf>. Accessed 30 Oct 2018
- Ministry of Finance (2015) *Green planning and budgeting strategy for Indonesia’s sustainable development, executive summary*. Jakarta, Indonesia. <http://www.kemenkeu.go.id/sites/default/files/gpb-strategy.pdf>. Accessed 30 Apr 2017
- Ostrom E (1990) *Governing the commons. The evolution of institutions for collective action*. Cambridge University Press, New York
- Ostrom E (2009) A general framework for analyzing sustainability of social-ecological systems. *Science* 325(5939):419–422. <https://doi.org/10.1126/science.1172133>
- Primdahl J, Kristensen LS, Swaffield S (2013) Current policy approaches and potentials of landscape strategy making as a policy integrating approach. *Appl Geogr* 42:86–94. <https://doi.org/10.1016/j.apgeog.2013.04.004>
- Reed MS (2008) Stakeholder participation for environmental management: a literature review. *Biol Conserv* 141(10):2417–2431. <https://doi.org/10.1016/j.biocon.2008.07.014>
- Reed J, Deakin L, Sunderland T (2014) What are ‘integrated landscape approaches’ and how effectively have they been implemented in the tropics—a systematic map protocol. *Environ Evid* 1–7. https://www.files/3382/Reed_et_al_2015_What/are/Integrated/Landscape/Approaches/and/how/effectively/have/they/been.pdf
- Reed J, Van Vianen J, Deakin EL, Barlow J, Sunderland T (2016) Integrated landscape approaches to managing social and environmental issues in the tropics: learning from the past to guide the future. *Glob Change Biol* 22(7):2540–2554. <https://doi.org/10.1111/gcb.13284>
- Reid FN et al (2005) *Ecosystems and human well-being*. Edited by Jose Sarukhan and Anne Whyte. Washington DC, USA: Island Press. <http://www.millenniumassessment.org/documents/document.356.aspx.pdf>
- Sayer J, Sunderland T, Ghazoul J, Pfund J-L, Sheil D, Meijaard E, Venter M et al (2013) ten principles for a landscape approach to reconciling agriculture, conservation, and other competing land uses. *Proc Natl Acad Sci* 110(21):8349–8356. <https://doi.org/10.1073/pnas.1210595110>
- Sayer J, Margules C, Boedhihartono AK, Dale A, Sunderland T, Supriatna J, Saryanthi R (2015) Landscape approaches; what are the pre-conditions for success? *Sustain Sci* 10(2):345–355. <https://doi.org/10.1007/s11625-014-0281-5>
- Sayer JA, Margules C, Boedhihartono AK, Sunderland T, Langston JD, Reed J, Riggs R et al (2017) Measuring the effectiveness of landscape approaches to conservation and development. *Sustain Sci* 12(3):465–476. <https://doi.org/10.1007/s11625-016-0415-z> (Springer Japan)

- Selman P (2008) What do we mean by sustainable landscape? Sustainability: science. Pract Policy 4(2):23–28. <https://doi.org/10.1080/15487733.2008.11908019>
- Sulistiyawan BS, Eichelberger BA, Verweij P, Rene' GAB, Hardian O, Adzan G, Sukmatoro W (2017) Connecting the fragmented habitat of endangered mammals in the landscape of Riau–Jambi–Sumatera Barat (RIMBA), central Sumatra, Indonesia (Connecting the Fragmented Habitat Due to Road Development). Glob Ecol Conserv 9:116–130. <https://doi.org/10.1016/j.gecco.2016.12.003> (Elsevier B. V.)
- UNECE UN (2008) Spatial planning: key instrument for development and effective governance with special reference to countries in transition. Geneva, Switzerland. http://www.unece.org/fileadmin/DAM/hlm/documents/Publications/spatial_planning.e.pdf. Accessed 11 Nov 2014
- UNEP (2011) Towards a green economy: pathways to sustainable development and poverty eradication. Sustain Dev. <https://doi.org/10.1063/1.3159605>. <http://www.unep.org>. Accessed 05 Feb 2017
- Wegenast T, Schneider G (2017) Ownership matters: natural resources property rights and social conflict in Sub-Saharan Africa. Polit Geogr 61:110–122. <https://doi.org/10.1016/j.polgeo.2017.07.007>
- Wyborn CA (2011) Landscape scale ecological connectivity: Australian survey and rehearsals. Pac Conserv Biol 17(2):121–131. <https://doi.org/10.1071/PC110121>
- Wyborn CA (2015) Connecting knowledge with action through coproductive capacities: adaptive governance and connectivity conservation. Ecol Soc 20(1):78

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